

[DESCRIPTION]

[Title of Invention] CONCENTRATION LEVEL PREDICTING SYSTEM,
CONCENTRATION LEVEL PREDICTING METHOD, AND PROGRAM

[Technical Field]

5 [0001]

The present disclosure relates to a concentration level predicting system, a concentration level predicting method, and a program.

[Background Art]

10 [0002]

Patent Literature (PTL) 1 discloses an information processing apparatus. When it is determined that a subject receives a stimulus caused by a change which deviates from a stationary state in an environment surrounding the subject, this information processing
15 apparatus detects an event-associated potential corresponding to the stimulus in a brain wave signal obtained by measuring the brain waves of the subject with a brain wave sensor. This information processing apparatus includes a calculator which calculates a value representing the concentration level of the subject on an object,
20 based on the feature quantity obtained from the detected event-associated potential.

[Citation List]

[Patent Literature]

[0003]

25 [PTL 1]

Japanese Unexamined Patent Application Publication No. 2013-42768

[Summary of Invention]

[Technical Problem]

30 [0004]

The present disclosure provides a concentration level predicting system, a concentration level predicting method, and a program which facilitate management of a user who executes an intellectual task.

35 [Solution to Problem]

[0005]

The concentration level predicting system according to one aspect of the present disclosure includes an obtainer, a calculator, and a predictor. The obtainer obtains a feature quantity pertaining to a living body activity of a user who is executing an intellectual task. The calculator calculates a concentration level of the user for the intellectual task, based on the feature quantity obtained by the obtainer. The predictor predicts a transition of the concentration level based on a change in the concentration level calculated by the calculator.

[0006]

The concentration level predicting method according to one aspect of the present disclosure includes obtaining, calculating, and predicting. In the obtaining, a feature quantity pertaining to a living body activity of a user who is executing an intellectual task is obtained. In the calculating, a concentration level of the user for the intellectual task is calculated based on the feature quantity obtained in the obtaining. In the predicting, a transition of the concentration level is predicted based on a change in the concentration level calculated in the calculating.

[0007]

The program according to one aspect of the present disclosure causes one or more processors to execute the concentration level predicting method.

[Advantageous Effects of Invention]

[0008]

The concentration level predicting system, the concentration level predicting method, and the program according to the present disclosure are advantageous in that these facilitate management of the user who is executing an intellectual task.

[Brief Description of Drawings]

[0009]

[FIG. 1]

FIG. 1 is a block diagram illustrating a functional configuration of the concentration level predicting system according to an

embodiment.

[FIG. 2]

FIG. 2 is a diagram illustrating an outline of an environment in which the concentration level predicting system according to the embodiment is used.

[FIG. 3]

FIG. 3 is a diagram illustrating one example of an image captured by an imaging apparatus.

[FIG. 4A]

FIG. 4A is a diagram illustrating one example of a result of prediction by a predictor in the concentration level predicting system according to the embodiment.

[FIG. 4B]

FIG. 4B is a diagram illustrating one example of a result of prediction by the predictor in the concentration level predicting system according to the embodiment.

[FIG. 5]

FIG. 5 is a flowchart illustrating an example of an operation of the concentration level predicting system according to the embodiment.

[Description of Embodiments]

[0010]

Hereinafter, an embodiment will be specifically described with reference to the drawings. The embodiment described below is generally or specifically illustrative. Numeric values, shapes, materials, components, arrangement positions of components, connection forms thereof, steps, order of steps, and the like shown in the embodiment below are exemplary, and should not be construed as limitations to the present disclosure. Moreover, among the components of the embodiments below, the components not described in an independent claim will be described as optional components.

[0011]

The drawings are schematic views, and are not necessarily precise illustrations. In the drawings, identical reference signs will

be given to substantially identical configurations, and the overlapping descriptions thereof will be omitted or simplified in some cases.

[0012]

5 [Embodiment]

[Configuration]

First, the configuration of concentration level predicting system 100 according to an embodiment will be described. FIG. 1 is a block diagram illustrating the functional configuration of concentration level predicting system 100 according to the embodiment. FIG. 2 is a diagram illustrating an outline of the environment in which concentration level predicting system 100 according to the embodiment is used.

[0013]

15 Concentration level predicting system 100 according to the embodiment is a system for predicting the concentration level of user U1 on an intellectual task. In the embodiment, the "intellectual task" is a task executed using the intellectual ability (intelligence) of user U1, and includes tasks such as recognition, thinking, and judgement. Specifically, the intellectual task can include desk work or study. In the embodiment, it is assumed that user U1 is a worker who works in an office or at home using an information terminal such as a personal computer. Accordingly, in the embodiment, the intellectual task designates desk work. Off course, user U1 may be a student or the like, for example, and the intellectual task in this case designates study.

[0014]

In the embodiment, the term "concentration" means that a person deals with something while paying attention to one thing. The "concentration level" means a degree of concentration. In other words, the term "concentration level" means how much the person concentrates attention on one thing when dealing with something. The concentration level affects the intellectual task amount per unit time (i.e., the working amount of intellectual task). Specifically, a higher concentration level results in a larger intellectual task amount

per unit time while a lower concentration level results in a smaller intellectual task amount per unit time.

[0015]

As illustrated in FIG. 1, concentration level predicting system 100 includes obtainer 11, calculator 12, predictor 13, controller 14, and storage 15. In the embodiment, it is sufficient that concentration level predicting system 100 includes obtainer 11, calculator 12, predictor 13, and controller 14, and may not include storage 15.

[0016]

In the embodiment, concentration level predicting system 100 is implemented by a server apparatus. The server apparatus may be installed in space 4 where user U1 stays (here, an office), or may be installed in a distant place remote from space 4. Alternatively, concentration level predicting system 100 may be implemented by a desktop or laptop personal computer or an information terminal such as a smartphone or a tablet terminal, rather than the server apparatus. Furthermore, concentration level predicting system 100 may be implemented by an information terminal used by user U1.

[0017]

As illustrated in FIGs. 1 and 2, imaging apparatus 2 and one or more apparatuses 3 are installed in space 4 where concentration level predicting system 100 is used, i.e., space 4 where user U1 stays.

[0018]

Imaging apparatus 2 is an apparatus which captures and generates an image, and is installed in a position enabling capturing of at least the head of user U1 from substantially the front side as illustrated in FIG. 3, user U1 being executing an intellectual task. FIG. 3 is a diagram illustrating one example of an image captured by imaging apparatus 2. Off course, the image capturing range of imaging apparatus 2 is not limited to the head of user U1, and may include the upper body of user U1 or the like. Imaging apparatus 2 is a camera, for example. Imaging apparatus 2 may be a camera installed in space 4 where user U1 stays, or may be a camera

included in the information terminal used by user U1. The image captured by imaging apparatus 2 is transmitted to obtainer 11 in concentration level predicting system 100. The communication between imaging apparatus 2 and obtainer 11 may be wired
5 communication or may be wireless communication, and any communication standards can be used without limitation. Imaging apparatus 2 may capture an image of user U1 with visible light or with infrared light.

[0019]

10 One or more apparatuses 3 can include one or more environment providing apparatuses 31 and one or more presenting apparatuses 32. In the embodiment, it is assumed that both of environment providing apparatus 31 and presenting apparatus 32 are installed in space 4 where user U1 stays. Off course, only one of
15 environment providing apparatus 31 and presenting apparatus 32 may be installed in space 4 where user U1 stays. In this case, among control examples described later, controller 14 does not execute control in a control example using apparatus 3 not installed in space 4 where user U1 stays.

20 [0020]

Environment providing apparatus 31 is an apparatus which provides an environment for space 4 where user U1 stays. Environment providing apparatus 31 may be installed on a ceiling, a wall, or a floor in space 4, or may be installed on furniture such as a
25 desk. Hereinafter, exemplary types of environment providing apparatus 31 will be listed.

[0021]

Environment providing apparatus 31 can include a light fixture. The light fixture provides a lighting environment to space 4 where
30 user U1 stays by lighting space 4 with illumination light. As one example, parameters for the lighting environment can include illuminance, color temperature, or luminous intensity distribution of the illumination light. As one example, the light fixture is a spotlight as task lighting for illuminating an ambient region of user
35 U1, and includes a light source including a solid light-emitting device

such as a light emitting diode (LED). The light source of the light fixture is configured to modulate light and/or color under control by controller 14. The light fixture may be a base light as ambient lighting which uniformly illuminates space 4, or may be a combination of a spotlight and a base light.

[0022]

Environment providing apparatus 31 can include an acoustic apparatus. The acoustic apparatus provides an acoustic environment to space 4 where user U1 stays by outputting sounds to space 4. As one example, parameters of the acoustic environment can include contents to be reproduced or the volume thereof. As one example, the acoustic apparatus is an omnidirectional loudspeaker, and reproduces contents transmitted from controller 14 under control by controller 14. The acoustic apparatus may be a directional loudspeaker such as a parametric loudspeaker, an ultrasonic loudspeaker, or a loudspeaker including a housing having a horn structure. Use of a directional loudspeaker is preferred because it facilitates a reduction in proportion of sounds which partially escape to another space.

[0023]

Environment providing apparatus 31 can include a fragrance generating apparatus. The fragrance generating apparatus provides a fragrance environment to space 4 where user U1 stays by diffusing fragrance ingredients to space 4. As one example, parameters of the fragrance environment can include the kinds of fragrance ingredients or the concentrations of the fragrance ingredients. As one example, the fragrance generating apparatus is an aroma diffuser.

[0024]

Environment providing apparatus 31 can include an air blowing apparatus. The air blowing apparatus provides an air environment to space 4 where user U1 stays by sending a controlled air stream (i.e., wind) to space 4. As one example, parameters of the air environment can include the amount of the air stream, the pattern, or the concentration of the gas (such as carbon dioxide)

contained in space 4. As one example, the air blowing apparatus is an electric fan, a circulator, or an air cleaner.

[0025]

Presenting apparatus 32 is an apparatus for presenting
5 information to user U1. For example, presenting apparatus 32 can include a display. When presenting apparatus 32 is a display, presenting apparatus 32 visually presents information to user U1 by displaying the information on the screen. Presenting apparatus 32 may be a display installed in space 4 where user U1 stays, or may be
10 a display included in the information terminal used by user U1. For example, presenting apparatus 32 can include a loudspeaker. When presenting apparatus 32 is a loudspeaker, presenting apparatus 32 auditorily presents information to user U1 by outputting the information in the form of a voice. Presenting apparatus 32 may be
15 a loudspeaker installed in space 4 where user U1 stays, or may be a loudspeaker included in the information terminal used by user U1.

[0026]

Obtainer 11 periodically (e.g., every several seconds) obtains images of user U1 transmitted from imaging apparatus 2. Here, as
20 already described, the image of user U1 contains at least the head of user U1 when viewed from substantially the front side. The image of the head of user U1 contains information on the state of the head of user U1 such as a tilt, the state of eyes of user U1 (such as inner corners of the eyes, the irides, cornea reflection, or the pupils), or
25 the expression of user U1. It can be said that each of these pieces of information is a so-called feature quantity pertaining to a living body activity of user U1. In other words, obtainer 11 obtains the feature quantity of a living body activity of user U1 who is executing an intellectual task.

[0027]

In the embodiment, after capturing the image of user U1, imaging apparatus 2 transmits the captured image to obtainer 11. Thus, in the embodiment, the cycle of obtaining the feature quantity by obtainer 11 is identical to that of capturing the image by imaging
35 apparatus 2. The term "identical" includes complete identicalness

as well as substantial identicalness.

[0028]

Calculator 12 calculates the concentration level of user U1 for the intellectual task, based on the image of user U1 obtained by
5 obtainer 11. As already described, the image of user U1 contains the feature quantity pertaining to the living body activity of user U1. In other words, calculator 12 calculates the concentration level of user U1 for the intellectual task, based on the feature quantity obtained by obtainer 11. Calculator 12 may calculate the
10 concentration level every time when obtainer 11 obtains the feature quantity, or may calculate the concentration level every time when obtainer 11 obtains a change (difference) in feature quantity.

[0029]

As one example, calculator 12 extracts one or more feature
15 quantities by executing appropriate image processing of the image of user U1 obtained by obtainer 11. Calculator 12 then calculates points of the extracted feature quantities for the concentration level by comparing the extracted feature quantities to the feature quantities in the corresponding template image. For example, the
20 point of each feature quantity is calculated corresponding to the degree of coincidence with that in the corresponding template image. Calculator 12 then adds the calculated points of the feature quantities, and calculates the concentration level based on the added points. When the points are added, the points may be weighed
25 according to the feature quantities. In the embodiment, the concentration level is expressed in terms of percentage where the maximum value is 100% and the minimum value is 0%. Alternatively, the concentration level may be expressed in a mode other than percentage. For example, the concentration level may
30 be expressed in terms of rankings such as level 1, level 2, and the like.

[0030]

Predictor 13 predicts the transition of the concentration level, based on the change in concentration level calculated by calculator
35 12. In other words, as illustrated in FIGs. 4A and 4B, predictor 13

predicts how the concentration level will change in the future from point in time t_1 at which the concentration level is calculated by calculator 12. In the embodiment, as one example, at point in time t_1 at which the concentration level is calculated by calculator 12, predictor 13 predicts whether a sign indicating that the concentration level will reduce to threshold Th_1 or below is present. For example, threshold Th_1 is a threshold limit presumed to enable recovery of the concentration level by user U_1 , and is preset. In other words, when the concentration level is not reduced to threshold Th_1 or below, it is considered that user U_1 can recover the concentration level to a level higher than threshold Th_1 . In contrast, when the concentration level is reduced to threshold Th_1 or below, it is considered that even if user U_1 tries to recover the concentration level to a level higher than threshold Th_1 , user U_1 has difficulties in achieving such recovery.

[0031]

FIGs. 4A and 4B each are a diagram illustrating one example of a result of prediction by predictor 13 in concentration level predicting system 100 according to the embodiment. In FIGs. 4A and 4B, the ordinate represents the concentration level, and the abscissa represents the time. FIG. 4A illustrates the case where the sign indicating that the concentration level will reduce to threshold Th_1 or below is not predicted at point in time t_1 at which the concentration level is calculated by calculator 12. FIG. 4B illustrates the case where the sign indicating that the concentration level will reduce to threshold Th_1 or below is predicted at point in time t_1 at which the concentration level is calculated by calculator 12. In the example illustrated in FIG. 4A, predictor 13 predicts that the concentration level will transit without reducing to threshold Th_1 or below, as indicated by the dashed-and-dotted line. In contrast, in the example illustrated in FIG. 4B, as indicated by the dashed-and-dotted line, predictor 13 predicts that the concentration level will transit and reach threshold Th_1 after a predetermined time has passes from point in time t_1 at which the concentration level is calculated by calculator 12.

[0032]

Hereinafter, prediction examples for the transition of the concentration level by predictor 13 will be listed. Predictor 13 executes one of a first prediction example and a second prediction example listed below. Off course, predictor 13 may predict the transition of the concentration level by an approach other than those in the first prediction example and the second prediction example described below.

[0033]

In the first prediction example, predictor 13 predicts the transition of the concentration level, based on one or more parameters of the concentration level calculated by calculator 12. As one example, the parameters can include a change amount of the concentration level per unit time (i.e., the inclination of the concentration level) or the length of the time during which the concentration level changes. For example, when the reduction amount of the concentration level per unit time is large or when the reduction in concentration level continues for a long time, predictor 13 predicts that the sign indicating that the concentration level will reduce to threshold Th1 or below is present. For example, when the reduction amount of the concentration level per unit time is small or when the reduction in concentration level continues for a short time, predictor 13 predicts that the concentration level will temporarily reduce and naturally recover thereafter.

[0034]

In the second prediction example, predictor 13 compares the time-series change in concentration level calculated by calculator 12 to a plurality of transition patterns stored in storage 15. When the time-series change partially coincides with any one of the transition patterns, predictor 13 predicts that the concentration level will transit according to the transition pattern. The term "time-series change in concentration level" used here indicates the history of the concentration level from point in time t1, at which the concentration level is calculated by calculator 12, to a preceding predetermined cycle. The term "transition pattern" used here indicates a pattern

obtained by performing a test on an unspecified number of users U1 to execute an intellectual task and actually calculating the transition of the concentration level during execution of the intellectual task. Although the transition patterns stored in storage 15 can be present corresponding to the number of users U1 who participated in the test, not all the transition patterns may be used.

[0035]

In the second prediction example, the sign indicating that the concentration level will reduce to threshold Th1 or below can be predicted even in a state where the concentration level is not actually reduced. For example, assume that a transition pattern is present in which a subtle change in concentration level has continued for a predetermined time and thereafter, the concentration level reduces to threshold Th1 or below. In this case, when the time-series change in concentration level calculated by calculator 12 coincides with the subtle change in concentration level in the transition pattern, predictor 13 predicts that the concentration level will transit according to the transition pattern. Thus, in this case, predictor 13 can predict the sign indicating that the concentration level will reduce to threshold Th1 or below in the state where the concentration level is not actually reduced.

[0036]

Controller 14 can communicate with apparatuses 3, and controls apparatuses 3 by transmitting control signals to apparatuses 3. The communication between controller 14 and apparatuses 3 may be wired communication, or may be wireless communication. Any communications standards can be used without limitation. In the embodiment, controller 14 controls apparatus 3 present in space 4 where user U1 stays, based on the transition of the concentration level predicted by predictor 13. In particular, in the embodiment, when predictor 13 predicts the sign indicating that the concentration level will reduce to threshold Th1 or below, controller 14 controls apparatus 3. In other words, controller 14 controls apparatus 3 at a timing at which the concentration level has not reached threshold Th1 yet and the sign indicating that the concentration level will reach

threshold Th1 or below is predicted, rather than at a timing at which the concentration level reaches threshold Th1 or below.

[0037]

Hereinafter, examples of control of apparatus 3 by controller 14 will be listed. A first example of control described below can be executed when one or more apparatuses 3 include environment providing apparatus 31. A second example of control and a third example of control described below can be executed when one or more apparatuses 3 include presenting apparatus 32. In other words, when one or more apparatuses 3 include both environment providing apparatus 31 and presenting apparatus 32, controller 14 can execute all of the first example of control to the third example of control.

[0038]

In the first example of control, when predictor 13 predicts the sign indicating that the concentration level will reduce to threshold Th1 or below, controller 14 causes environment providing apparatus 31 to change the environment of space 4 where user U1 stays. Controller 14 may control only one environment providing apparatus 31, or may control a plurality of environment providing apparatuses 31.

[0039]

Specifically, when environment providing apparatus 31 includes a light fixture, controller 14 causes the light fixture to change illuminance, color temperature, or luminous intensity distribution of the illumination light.

[0040]

When environment providing apparatus 31 includes an acoustic apparatus, controller 14 causes the acoustic apparatus to reproduce contents or change the sound volume thereof when the contents are already reproduced.

[0041]

When environment providing apparatus 31 includes a fragrance generating apparatus, controller 14 causes the fragrance generating apparatus to diffuse fragrance ingredients or change the

kinds or concentrations of the fragrance ingredients when the fragrance ingredients are already diffused.

[0042]

5 When environment providing apparatus 31 includes an air blowing apparatus, controller 14 causes the air blowing apparatus to generate an air stream or change the air amount when the air stream is already generated. The air blowing apparatus may directly blow the air to user U1, or may indirectly blow the air to user U1.

[0043]

10 In the first example of control, user U1 is prompted to have physiological or mental refreshment by changing the environment of space 4 where user U1 stays, thereby reducing mental fatigue of user U1. Thereby, recovery of the concentration level of user U1 is expected.

15 [0044]

In the first example of control, controller 14 may cause environment providing apparatus 31 to instantaneously change the environment at a point in time at which predictor 13 predicts the sign indicating that the concentration level will reduce to threshold Th1 or below, and to immediately return the environment to the original state. Alternatively, in the first example of control, controller 14 may cause environment providing apparatus 31 to maintain the environment in a state changed from that at a point in time at which predictor 13 predicts the sign indicating that the concentration level will reduce to threshold Th1 or below, and to return the environment to the original state at a point in time at which the concentration level is recovered.

[0045]

30 In the second example of control, when predictor 13 predicts the sign indicating that the concentration level will reduce to threshold Th1 or below, controller 14 controls presenting apparatus 32 based on remaining time Tr1 until point in time t3 which is a scheduled end point in time of the intellectual task. In the embodiment, as illustrated in FIG. 4B, remaining time Tr1 is a time from point in time t2, at which predictor 13 predicts the sign

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indicating that the concentration level will reduce to threshold Th1 or below, to point in time t3 which is a scheduled end point in time of the intellectual task and is preset by user U1 or a manager of concentration level predicting system 100. Here, point in time t2 at which the sign indicating that the concentration level will reduce to threshold Th1 or below is the same point in time as point in time t1 at which the concentration level is calculated by calculator 12.

[0046]

Specifically, when remaining time Tr1 is longer than the threshold time, controller 14 causes presenting apparatus 32 to prompt user U1 to concentrate on the intellectual task. For example, when presenting apparatus 32 is a display, controller 14 causes the display to display a character string or an image having a content to promote concentration, such as "Put on a final spurt!" or "One more spurt!", at remaining time Tr1. For example, when presenting apparatus 32 is a loudspeaker, controller 14 causes the loudspeaker to output a voice which reads the character string. Thereby, user U1 is expected to execute the intellectual task without losing the concentration in remaining time Tr1. To be noted, user U1 may appropriately select whether to obey the content presented by presenting apparatus 32.

[0047]

When remaining time Tr1 is shorter than the threshold time, controller 14 causes presenting apparatus 32 to prompt user U1 to stop the intellectual task. For example, when presenting apparatus 32 is a display, controller 14 causes the display to display a character string or an image having a content to promote stop of the intellectual task, such as "Take a mini-break?". For example, when presenting apparatus 32 is a loudspeaker, controller 14 causes the loudspeaker to output a voice which reads the character string. Thereby, user U1 is expected to stop the intellectual task and have a break. To be noted, user U1 may appropriately select whether to obey the content presented by presenting apparatus 32.

[0048]

In the third example of control, controller 14 causes

presenting apparatus 32 to present the transition of the concentration level predicted by predictor 13 to user U1. For example, when presenting apparatus 32 is a display, controller 14 causes the display to display a graph illustrated in FIG. 4A or 4B.

5 Thereby, user U1 can know the transition of the concentration level of his/her own. When predictor 13 predicts the sign indicating that the concentration level will reduce to threshold Th1 or below, controller 14 may cause the display to display remaining time Tr1, rather than to display the graph illustrated in FIG. 4B.

10 [0049]

Storage 15 is a memory device in which information (such as computer programs) needed for operations of calculator 12, predictor 13, and controller 14 is stored. For example, storage 15 is implemented with a hard disk drive (HDD), and may be implemented
15 with a semiconductor memory. Any known electronic information storing device can be used without limitation. As one example, storage 15 stores the template image of the feature quantities used in calculator 12, the transition pattern used in predictor 13, and the contents of control of apparatuses 3.

20 [0050]

[Operation]

Hereinafter, one example of the operation of concentration level predicting system 100 according to the embodiment will be described with reference to FIG. 5. FIG. 5 is a flowchart illustrating
25 an operational example of concentration level predicting system 100 according to the embodiment. In the following description, it is assumed that one or more apparatuses 3 include at least one of environment providing apparatus 31 and presenting apparatus 32.

[0051]

30 Initially, obtainer 11 obtains the feature quantity of an living body activity of user U1 who is executing an intellectual task, by obtaining an image of user U1 transmitted from imaging apparatus 2 (S1). Processing S1 corresponds to obtaining step ST1 in the concentration level predicting method. Next, calculator 12
35 calculates the concentration level of user U1 for the intellectual task,

based on the feature quantity obtained by obtainer 11 (S2). Processing S2 corresponds to calculating step ST2 in the concentration level predicting method. Predictor 13 then predicts the transition of the concentration level, based on the concentration level calculated by calculator 12 (S3). Processing S3 corresponds to predicting step ST3 in the concentration level predicting method.
[0052]

When predictor 13 predicts the sign indicating that the concentration level will reduce to threshold Th1 or below (S4: Yes), controller 14 controls apparatus 3 installed in space 4 where user U1 stays (S5). In contrast, when the sign indicating that the concentration level will reduce to threshold Th1 or below is not predicted by predictor 13 (S4: No), nothing is executed in particular.
[0053]

Here, when apparatus 3 includes environment providing apparatus 31 (S6: Yes), controller 14 causes environment providing apparatus 31 to change the environment of space 4 where user U1 stays (S7). When apparatus 3 includes presenting apparatus 32 (S8: Yes), based on remaining time Tr1 until point in time t3 which is a scheduled end point in time of the intellectual task, controller 14 causes presenting apparatus 32 to present information to user U1 (S9).
[0054]

When apparatus 3 includes presenting apparatus 32 and remaining time Tr1 is longer than the threshold time (S10: Yes), controller 14 causes presenting apparatus 32 to present information for prompting user U1 to concentrate on the intellectual task (S11). In contrast, when remaining time Tr1 is shorter than the threshold (S10: No), controller 14 causes presenting apparatus 32 to present information for prompting user U1 to stop the intellectual task (S12). Thereafter, the series of processings S1 to S12 is repeated.
[0055]

[Advantages]

Hereinafter, advantages of concentration level predicting system 100 according to the embodiment will be described with

comparison to the system according to Comparative Example. Unlike concentration level predicting system 100 according to the embodiment, the system according to Comparative Example does not include predictor 13. The system according to Comparative Example controls apparatus 3 according to the concentration level calculated by calculator 12. In other words, the system according to Comparative Example takes some action to user U1 by controlling apparatus 3 only after the concentration level has actually reduced to threshold Th1 or below, and this may be too late for control in some cases.

[0056]

For example, as its feature, once the concentration level is completely reduced, the concentration level is difficult to recover even though the recovery is attempted. For this reason, the system according to Comparative Example controls environment providing apparatus 31 at a point in time at which the concentration level is actually reduced to threshold Th1 or below, and then changes the environment of space 4 where user U1 stays. Thus, the recovery of the concentration level by changing the environment cannot be expected.

[0057]

In contrast, concentration level predicting system 100 according to the embodiment is advantageous in that it can predict how the concentration level will change in the future from point in time t1 at which the concentration level is calculated, therefore facilitating management of user U1 who executes the intellectual task. For example, concentration level predicting system 100 according to the embodiment can change the environment of space 4 where user U1 stays by controlling environment providing apparatus 31 before the concentration level reaches threshold Th1 or below. For this reason, unlike the system according to Comparative Example, concentration level predicting system 100 according to the embodiment can attempt the recovery of the concentration level before the concentration level is completely reduced, therefore facilitating the recovery of the concentration level. Thus,

concentration level predicting system 100 according to the embodiment is advantageous in that it can take a variety of actions before the concentration level is completely reduced.

[0058]

5 [Other embodiments]

Although the embodiment has been described as above, the embodiment above should not be construed as limitations to the present disclosure. Modifications of the embodiment will now be listed. The modifications described below may be appropriately
10 combined.

[0059]

Although in the embodiment, calculator 12 calculates the concentration level based on the image of user U1 obtained by obtainer 11, any other aspect can be conceived. For example,
15 calculator 12 may calculate the concentration level based on the information about the eyes of user U1 or the vital information about the heart rate of user U1. In this aspect, obtainer 11 may obtain the vital information from a sensor which detects the vital information, rather than obtains the image from imaging apparatus 2.

20 [0060]

In the embodiment, predictor 13 may predict the transition of the concentration level not only based on the concentration level calculated by calculator 12, but also by referring to another parameter. For example, predictor 13 may further refer to a
25 parameter such as the type of the intellectual task which user U1 is executing, the time zone in which user U1 is executing the intellectual task, or the place in which user U1 is executing the intellectual task.

[0061]

Although in the embodiment, the feature quantity of the living
30 body activity of user U1 obtained by obtainer 11 is mainly the information pertaining to the head of user U1, the information is not limited to this. For example, the feature quantity may include information pertaining to a part of user U1 other than the head, such
35 as the movement of the shoulders of user U1.

[0062]

Although in the embodiment, concentration level predicting system 100 treats one user U1, any other configuration can be used. For example, concentration level predicting system 100 may treat a plurality of users U1, and may execute the series of processings such as the prediction of the transition of the concentration level for each of users U1.

[0063]

When concentration level predicting system 100 treats a plurality of users U1, controller 14 may cause environment providing apparatus 31 to provide an environment unique to each user U1. In this aspect, when the environment of space 4 where user U1 stays is changed, an environment tailored to each user U1 can be more readily provided. This can lead to an expectation on an effect of further facilitating the recovery of the concentration level of user U1.

[0064]

Although in the embodiment, imaging apparatus 2 and apparatus 3 are not included in the components included in concentration level predicting system 100, at least one of imaging apparatus 2 and apparatus 3 may be included in the components included in concentration level predicting system 100.

[0065]

Moreover, for example, in the embodiment above, concentration level predicting system 100 is implemented with a server apparatus, that is, a single apparatus. Alternatively, concentration level predicting system 100 which may be implemented with a plurality of apparatuses is implemented with a plurality of apparatuses, the components included in concentration level predicting system 100 may be distributed to the plurality of apparatuses in any manner. For example, in the embodiment, the components included in the server apparatus may be included in an information terminal installed in a closed space. In other words, the present disclosure may be implemented by cloud computing, or may be implemented by edge computing.

[0066]

For example, the apparatuses in the above embodiment can communicate with each other by any communication method. Moreover, the communication between the apparatuses may be mediated by a relay apparatus not shown.

5 [0067]

Moreover, in the above embodiment, the components may be implemented by executing software programs suitable for the components. The components may be implemented by a program executor such as a CPU or a processor which reads and executes the software programs recorded on a recording medium such as a hard disk or a semiconductor memory.

[0068]

Alternatively, the components may be implemented by hardware. For example, the components may be circuits (or integrated circuits). These circuits may form a single circuit as a whole, or may be individual circuits. Moreover, these circuits may be general-purpose circuits, or may be dedicated circuits.

[0069]

Moreover, general or specific aspects of the present disclosure may be implemented with a system, an apparatus, a method, an integrated circuit, a computer program, or a recording medium such as a computer-readable CD-ROM. Alternatively, general or specific aspects of the present disclosure may be implemented with any combination of a system, an apparatus, a method, an integrated circuit, a computer program, and a recording medium.

[0070]

For example, the present disclosure may be implemented as a concentration level predicting method to be executed by a computer such as concentration level predicting system 100, may be implemented as a program for causing a computer to execute such a concentration level predicting method, or may be implemented as a non-transitory computer-readable recording medium on which such a program is recorded.

[0071]

Besides, the present disclosure also covers embodiments

obtained by subjecting the embodiments to a variety of modifications conceived by persons skilled in the art, or embodiments implemented with any combination of the components and functions in the embodiments without departing the gist of the present disclosure.

5 [0072]

[Conclusion]

As described above, concentration level predicting system 100 includes obtainer 11, calculator 12, and predictor 13. Obtainer 11 obtains a feature quantity pertaining to a living body activity of user
10 U1 who is executing an intellectual task. Calculator 12 calculates the concentration level of user U1 for the intellectual task, based on the feature quantity obtained by obtainer 11. Predictor 13 predicts a transition of the concentration level, based on a change in the concentration level calculated by calculator 12.

15 [0073]

Such concentration level predicting system 100 is advantageous in that it can predict how the concentration level will change in the future from point in time t_1 at which the concentration level is calculated, therefore facilitating management of user U1 who
20 executes the intellectual task.

[0074]

Moreover, for example, concentration level predicting system 100 further includes controller 14 which controls apparatus 3 present in space 4 where user U1 stays, based on the transition of the
25 concentration level predicted by predictor 13.

[0075]

Such concentration level predicting system 100 is advantageous in that it can approach user U1 who is executing the intellectual task, by controlling apparatus 3, therefore further
30 facilitating management of user U1 who is executing the intellectual task.

[0076]

Moreover, for example, in concentration level predicting system 100, controller 14 controls apparatus 3 when predictor 13
35 predicts a sign indicating that the concentration level will reduce to

threshold Th1 or below.

[0077]

Such concentration level predicting system 100 is advantageous in that it controls apparatus 3 before the concentration
5 level is completely reduced, thereby further facilitating taking an action against a reduction in concentration level, compared to the case where apparatus 3 is controlled after the concentration level is completely reduced.

[0078]

10 Moreover, for example, in concentration level predicting system 100, apparatus 3 includes environment providing apparatus 31 which provides an environment to space 4. When predictor 13 predicts the sign, controller 14 causes environment providing apparatus 31 to change the environment.

15 [0079]

Such concentration level predicting system 100 is advantageous in that the environment of space 4 is changed before the concentration level is completely reduced, thereby further
20 facilitating the recovery of the concentration level compared to the case where the environment of space 4 is changed after the concentration level is completely reduced.

[0080]

Moreover, for example, in concentration level predicting system 100, apparatus 3 includes presenting apparatus 32 which
25 presents information to user U1. When predictor 13 predicts the sign, controller 14 controls presenting apparatus 32 based on remaining time Tr1 until point in time t3 which is a scheduled end point in time of the intellectual task

[0081]

30 Such concentration level predicting system 100 is advantageous in that an appropriate suggestion is more readily presented to user U1 according to remaining time Tr1.

[0082]

Moreover, for example, in concentration level predicting
35 system 100, when remaining time Tr1 is longer than a threshold time,

controller 14 causes presenting apparatus 32 to prompt user U1 to concentration on the intellectual task.

[0083]

5 Such concentration level predicting system 100 is advantageous in that it can be expected that user U1 can execute the intellectual task without losing the concentration at remaining time Tr1, and working efficiency of the intellectual task at remaining time Tr1 can be expected to improve.

[0084]

10 Moreover, for example, in concentration level predicting system 100, when remaining time Tr1 is shorter than the threshold time, controller 14 causes presenting apparatus 32 to prompt user U1 to stop the intellectual task.

[0085]

15 Such concentration level predicting system 100 is advantageous in that it can be expected that user U1 stops the intellectual task and has a break, facilitating avoiding a state where user U1 with reduced concentration continues the intellectual task.

[0086]

20 Moreover, for example, in concentration level predicting system 100, apparatus 3 includes presenting apparatus 32 which presents information to user U1. Controller 14 causes presenting apparatus 32 to present the transition of the concentration level predicted by predictor 13 to user U1.

25 [0087]

Such concentration level predicting system 100 is advantageous in that user U1 can know the transition of the concentration level of his/her own, further facilitating self-managing about how to execute the intellectual task.

30 [0088]

Moreover, for example, the concentration level predicting method includes obtaining step ST1, calculating step ST2, and predicting step ST3. In obtaining step ST1, a feature quantity pertaining to a living body activity of user U1 who is executing an
35 intellectual task is obtained. In calculation step ST2, the

concentration level of user U1 for the intellectual task is calculated based on the feature quantity obtained in obtaining step ST1. In predicting step ST3, a transition of the concentration level is predicted based on a change in the concentration level calculated in calculating step ST2.

[0089]

Such a concentration level predicting method is advantageous in that it enables prediction how the concentration level will change in the future from point in time t1 at which the concentration level is calculated, further facilitating user U1 who executes the intellectual task.

[0090]

Moreover, for example, a program causes one or more processors to execute the concentration level predicting method described above.

[0091]

Such a program is advantageous in that it enables prediction how the concentration level will change in the future from point in time t1 at which the concentration level is calculated, further facilitating user U1 who executes the intellectual task.

[Reference Signs List]

[0092]

100 concentration level predicting system

11 obtainer

12 calculator

13 predictor

14 controller

3 apparatus

31 environment providing apparatus

32 presenting apparatus

4 space

ST1 obtaining step

ST2 calculating step

ST3 predicting step

t3 scheduled point in time

Th1 threshold
Tr1 remaining time
U1 user

[CLAIMS]

[Claim 1]

A concentration level predicting system comprising:

- an obtainer which obtains a feature quantity pertaining to a
5 living body activity of a user who is executing an intellectual task;
a calculator which calculates a concentration level of the user
for the intellectual task, based on the feature quantity obtained by
the obtainer; and
a predictor which predicts a transition of the concentration
10 level based on a change in the concentration level calculated by the
calculator.

[Claim 2]

- The concentration level predicting system according to claim 1,
15 further comprising:
a controller which controls an apparatus present in a space
where the user stays, based on the transition of the concentration
level predicted by the predictor.

20 [Claim 3]

- The concentration level predicting system according to claim
2,
wherein the controller controls the apparatus when the
predictor predicts a sign indicating that the concentration level will
25 reduce to a threshold or below.

[Claim 4]

- The concentration level predicting system according to claim
3,
30 wherein the apparatus includes an environment providing
apparatus which provides an environment to the space, and
when the predictor predicts the sign, the controller causes the
environment providing apparatus to change the environment.

35 [Claim 5]

The concentration level predicting system according to claim 3 or 4,

wherein the apparatus includes a presenting apparatus which presents information to the user, and

5 when the predictor predicts the sign, the controller controls the presenting apparatus based on a remaining time until a scheduled end point in time of the intellectual task.

[Claim 6]

10 The concentration level predicting system according to claim 5,

wherein when the remaining time is longer than a threshold time, the controller causes the presenting apparatus to prompt the user to concentrate on the intellectual task.

15

[Claim 7]

The concentration level predicting system according to claim 5,

20 wherein when the remaining time is shorter than a threshold time, the controller causes the presenting apparatus to prompt the user to stop the intellectual task.

[Claim 8]

25 The concentration level predicting system according to any one of claims 2 to 7,

wherein the apparatus includes a presenting apparatus which presents information to the user, and

30 the controller causes the presenting apparatus to present the transition of the concentration level to the user, the transition of the concentration level being predicted by the predictor.

[Claim 9]

A concentration level predicting method comprising:
obtaining a feature quantity pertaining to a living body activity
35 of a user who is executing an intellectual task;

calculating a concentration level of the user for the intellectual task, based on the feature quantity obtained in the obtaining; and predicting a transition of the concentration level based on a change in the concentration level calculated in the calculating.

5

[Claim 10]

A program causing one or more processors to execute the concentration level predicting method according to claim 9.